

A NOTE ON THE REORIENTATION WITHIN THE SPINDLE OF THE SEX TRIVALENT IN A MANTID

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In most mantids during the formation of the spindle in late meiotic prophase, the kinetochores of each bivalent move suddenly apart towards opposite poles stretching the chromosomes. This is known as the premetaphase stretch stage and is followed first by recontraction of the chromosomes and only then by their gradual congression at the equator to form the metaphase plate. The bivalents move to the equator with no change in their original orientation of one kinetochore to each pole. The behaviour of the sex trivalents, however, both during the stretch stage and the ensuing congression, presents a more complicated situation. As normal behaviour one would expect the X_1X_2 kinetochores to orient towards one pole and the Y kinetochore towards the other, but actually a large number of sex trivalents appear to orient at random. There result, in addition to normal orientation, several types of malorientation. White (1941) first observed such malorientation of sex trivalents; he noted a high frequency of malorientation in 3 species of mantids and concluded that some reorientation must take place before metaphase formation. The conclusive proof for such reorientation was given by Hughes-Schrader (1943), who demonstrated, in *Stagmomantis carolina*, a decrease in the number of maloriented sex trivalents between premetaphase stretch and final metaphase. In the present note are recorded observations on *Hierodula* sp. which show that in this species also reorientation of trivalents takes place.

The material consists of testes fixed in PFA3, from a nymph of *Hierodula* sp., collected near Bombay (India), and placed at my disposal by Professor J. J. Asana to whom I am greatly indebted. Sections ranging from 6 to 10 μ and stained in iron haematoxylin were used for the study.

The presence of a sex trivalent in this species of *Hierodula* (specific identification is not available) was recorded by Asana (1934) who also established the total number of chromosomes in the male as 27. Later Oguma (1946) recorded the same chromosome complement in the males of four species of *Hierodula*.

In the present material all sex trivalents in which a lateral view of the spindle is presented during the premetaphase stretch, and again during the metaphase were counted. Those trivalents whose position prevented a positive determination of their orientation were also recorded. During the stretch stage various types of orientation were found. In some cases one of the X's was oriented towards one pole while the other X and the Y were oriented towards the opposite pole; in others the Y was stretched between the two X's while in the rest the orientation was normal. These configurations, assumed by the sex trivalents during the premeta-

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phase stretch, involve a genuine orientation of the kinetochores to the division center comparable to that ordinarily occurring at metaphase. This is shown not only by the position of the chromosomes and their attenuation at the kinetochores but also by the fact that chromosomal fibers are formed between the center and the kinetochore in both maloriented and normally oriented chromosomes.

TABLE I

Orientation of sex trivalent during premetaphase stretch and at metaphase

	Normal	Malorientation			Total	Not analyzable
	$\begin{array}{c} X_1X_2 \\ \downarrow \\ Y \end{array}$	$\begin{array}{c} X_1 \\ \downarrow \\ Y \\ \downarrow \\ X_2 \end{array}$	$\begin{array}{c} X_1Y \\ \downarrow \\ X_2 \end{array}$	$\begin{array}{c} X_2Y \\ \downarrow \\ X_1 \end{array}$		
Premetaphase	42 = 65.6 per cent	15	7	22 = 34.4 per cent	36	
Metaphase	149 = 97.4 per cent	3	1	4 = 2.6 per cent	0	

It will be seen from Table I that during premetaphase stretch as many as 34.4 per cent of all analyzable sex trivalents are maloriented. This number is, however, strikingly reduced to 2.6 per cent in metaphase. Even if all non-analyzable trivalents were assumed to be normally oriented, still the number of maloriented sex trivalents is 22.0 per cent of the total, which is quite significant in relation to the 2.6 per cent of malorientation found at metaphase. This clearly proves the occurrence of reorientation in *Hierodula* and supports the earlier observations of White and Hughes-Schrader. This conclusion leads us to the basic question of what processes underlie the reorientation. The probable explanation must be sought in the role of the kinetochore. Further investigation of this problem in other species of mantids is planned.

SUMMARY

During the stretch stage in the meiosis of the male *Hierodula* a high percentage of malorientation of the sex trivalent is found. At metaphase, however, the number of maloriented configurations is so small that a considerable amount of reorientation must occur between these two phases. The forces involved are obviously of some significance in the general problem of the mitotic mechanism.

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